Historical Perspectives on Climate Change

EES 3310/5310

Global Climate Change

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Connecting the Pieces

Connecting the Pieces

1. Targets for emissions & temperature
2. Connecting new policies to previous international agreements & treaties
3. International coordination & enforcement
4. National policy enforcement
5. Innovation, invention, deployment of low-carbon energy

Temperature Limits

- Why does so much policy discussion focus on a 2°C target?
  - Where does 2°C come from?
    - 2°C above what?
  - Is there something special about 2°C?

History of Climate Agreements

Political Timeline

- 1979: World Climate Conference
- 1988: UN Resolution 43/53:

  Protection of global climate for present and future generations of mankind

  - IPCC established by WMO, UNEP
    - Review research; report on climate change science
- 1992: UN Framework Convention on Climate Change (UNFCCC)
  - Prevent "*dangerous*" interference with climate
  - Details left for future treaties
- 1997: Kyoto Protocol: Implements UNFCCC
- 2009: Copenhagen Accord
- 2015: Paris Accord

International Policy

- UNFCCC (1992):
  - Stabilize greenhouse gas concentrations to prevent "*dangerous*" interference with climate
  - "Lack of full scientific certainty should not be used as a reason for postponing such measures"
  - How do you define *dangerous*?
    - *Dangerous* compared to what?
    - Who should choose the definition?
    - Does this put scientists in the position of making value judgments for everyone else?

Kyoto Protocol (1997–2012)

- Emissions cuts:
  - “Common but differentiated responsibilities”
  - Industrialized nations (“Annex 1”)
    - Cut greenhouse gas emissions 5% or more below 1990 levels by 2008.
  - Transition nations (Former Soviet/Warsaw Pact):
    - Given more time to act
  - Developing nations (“Non-Annex”)
    - China, India, much of Africa, etc.
    - No obligations
  - Clean Development Mechanism
    - Incentive for developed nations to help less-developed nations to adopt clean energy, sustainable practices.

Copenhagen Accord (2009)

- No consensus on binding action
- Informal agreement to limit warming to 2° C
  - Encouraged non-binding national pledges to limit emissions
  - Brought attention to deforestation
  - Pledged $30 billion over 3 years, rising to $100 billion per year by 2020 from developed nations to support action by developing nations

Paris Accord (2015)

- Pledge to keep warming below 2° C, with aspiration to keep it below 1.5° C
- Nationally Determined Commitments to reduce emissions
  - Voluntary and non-binding; no enforcement mechanism.
  - Commitments fall far short of what’s needed to achieve 2° C
- “Stocktaking” in 2023 and every 5 years thereafter to assess progress and adjust national commitments.

Analysis

Pielke on IPCC and Policy

- Detection vs. Attribution of Climate Change
  - Detection: "*Is climate changing*?"
  - Attribution: "***Why** is climate changing*?"
- IPCC has concluded that
  - Climate is changing (>99% certainty)
    - Last 30 years are the warmest in at least 1400 years (>66% certainty)
  - Human actions are causing most of the climate change observed in the last 50 years (>95% certainty)

Pielke on IPCC and Policy

- CO_2 as control-knob metaphor
  - Pielke: Too much emphasis on CO_2
  - Others: CO_2 is unique: magnitude and duration
    - See, Richard Alley, “The Biggest Control Knob: Carbon Dioxide in Earth’s Climate History” (Dec. 2009)

      https://www.youtube.com/watch?v=RffPSrRpq_g

Pielke on IPCC and Policy

- Adaptation vs. Mitigation:
  - Bias against adaptation
    - Adaptation is necessary: “committed” warming
    - Limits to adaptation:
      - Deadly heat waves
      - Disruption of ecosystem services
      - Catastrophic sea-level rise
    - Less mitigation → more expensive adaptation
    - Find the best balance

Economics and the Social Cost of Carbon

Social Cost of Carbon

- Cost of doing nothing (different scenarios)
- Convert to cost-per-tonne of emissions
- Some people report cost per tonne carbon and others report cost per tonne CO_2

Note:

- tonne = metric ton = 2200 points = 1.1 English tons
- GT = gigatonne = billion tonnes
- 1 tonne C = 3.7 tonne CO_2

Social Cost of Carbon

Example:

- Emit 5500 GT CO_2 between now and 2100 (5500 GT CO_2 = 1500 GT C)
- Half stays in atmosphere, doubles CO_2 concentration
- Suppose climate change reduces world GDP by $2 trillion per year for 100 years

$$\frac{\$2 \text{ trillion/year} \times 100 \text{ years}}{5500 \text{ GT CO}_2} = \frac{\$200 \text{ trillion}}{5.5 \text{ trillion tonnes CO}_2}$$

$$= \$36 \text{ per tonne CO}_2$$

$$= \$135 \text{ per tonne C}^2$$

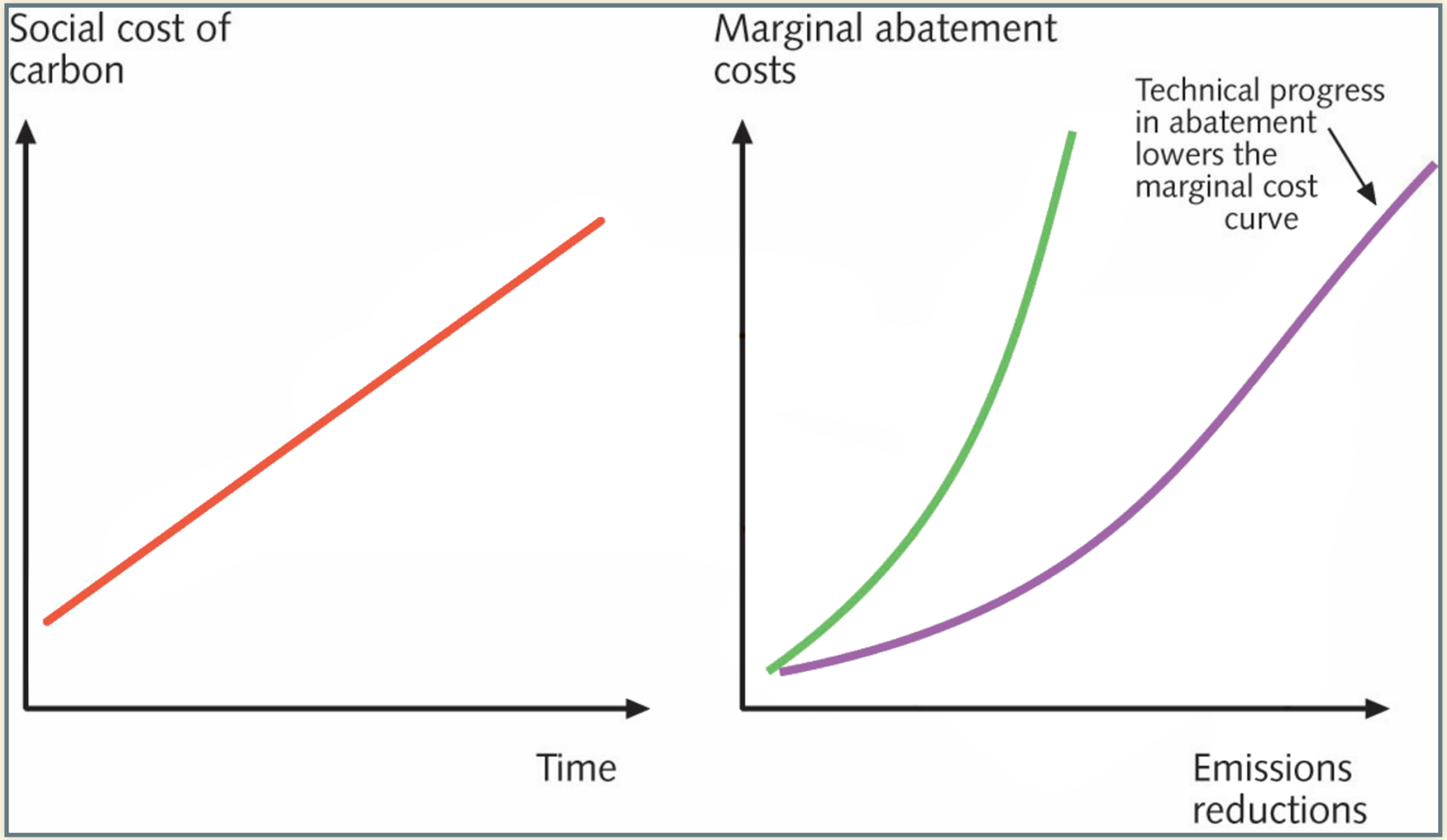
Social Cost of Carbon

- 1 gallon gasoline
  - 20 pounds CO_2 = 0.009 tonne CO_2
- \$1 per tonne CO_2 = \$0.009 per gallon
  - Roughly 1 cent per gallon
- A social cost of \$36 per tonne CO_2 means gasoline costs society roughly \$0.36 per gallon

Social Cost of Carbon

- Social cost rises with CO_2 concentration
  - Small warming has very low social cost per tonne
  - Larger warming has high social cost per tonne
- Stern Report
  - \$85 per tonne CO_2 under BAU (\$0.77/gallon gas)
  - \$30 per tonne if we stabilize at 550 ppm (\$0.27/gallon)
  - \$25 per tonne if we stabilize at 450 ppm (\$0.22/gallon)
- Low concentrations of CO_2 = low social cost per tonne
  - but high cost of emissions reduction
  - Hard to justify
- Find best balance between social cost of warming versus cost of reducing emissions
- Cost of reducing emissions drops over time
  - Innovation, new technology

Why social cost is useful



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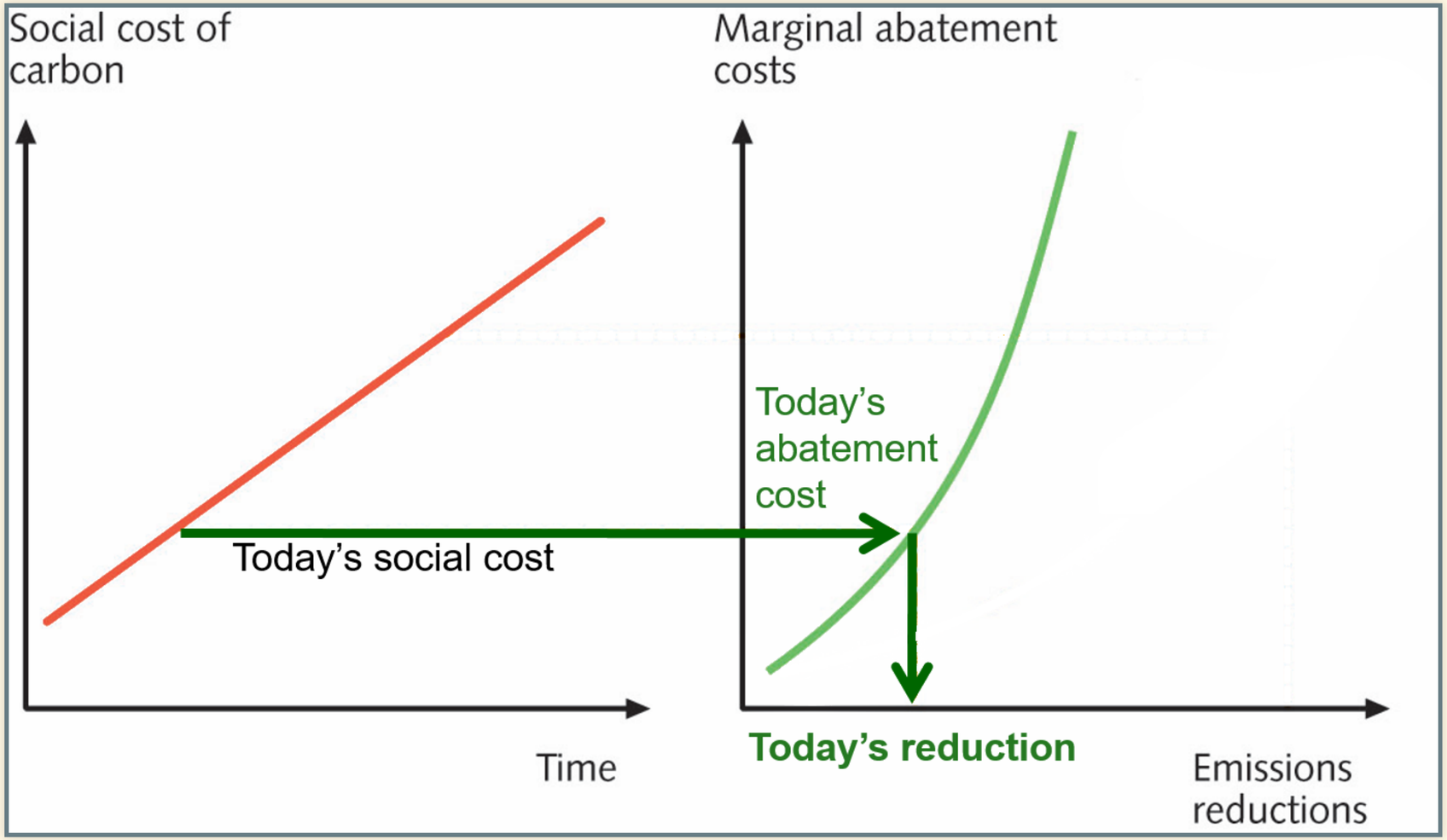

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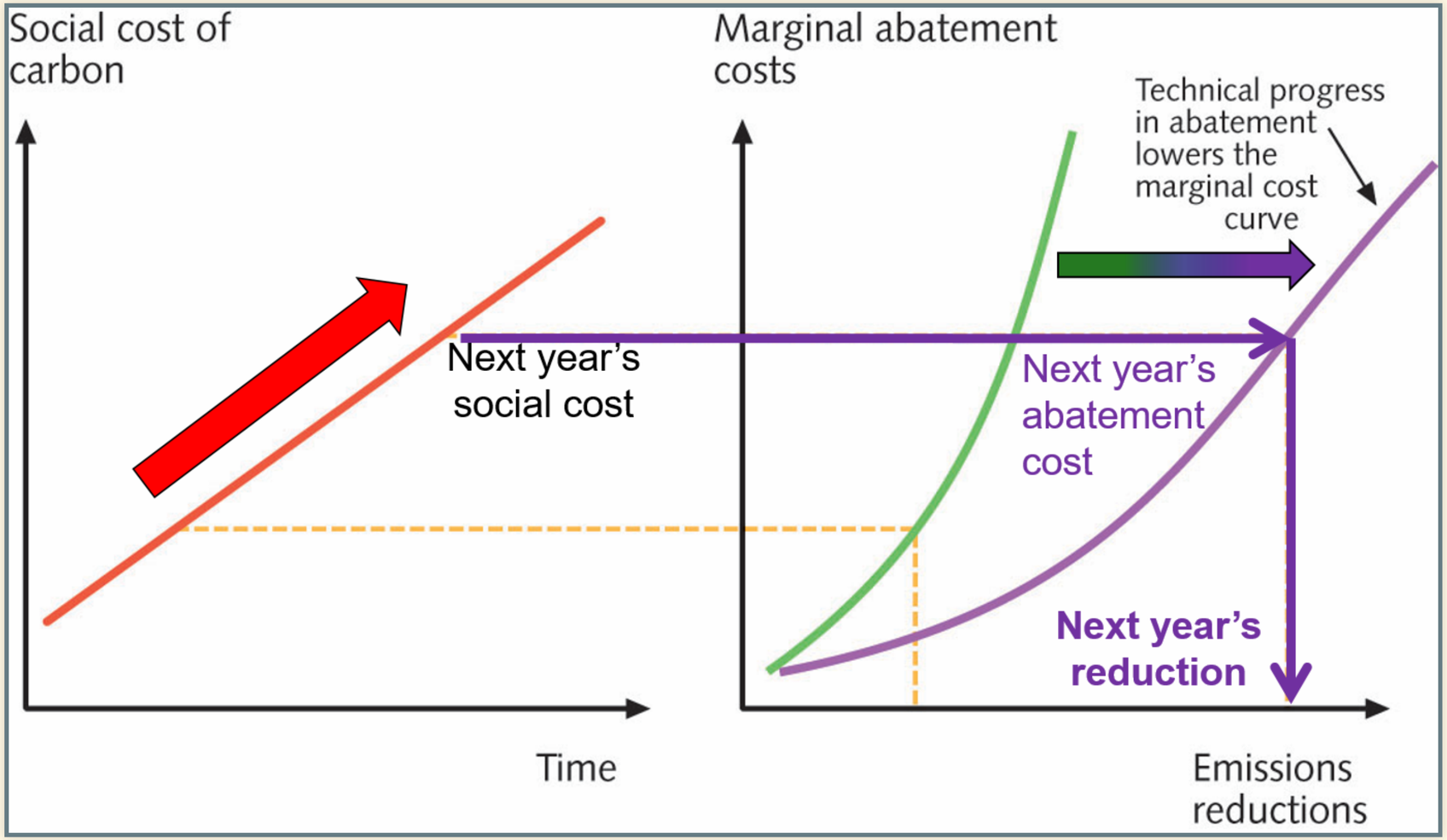

Implications

- Optimum policy would begin with a low price on carbon today
  - Small emissions reductions in near-term
- Over time:
  - Cost of reducing emissions drops
  - Rising CO_2 concentration raises price of carbon
  - Emissions reductions become more aggressive